

Jet Structure
sPHENIX General Meeting
August 5th 2016

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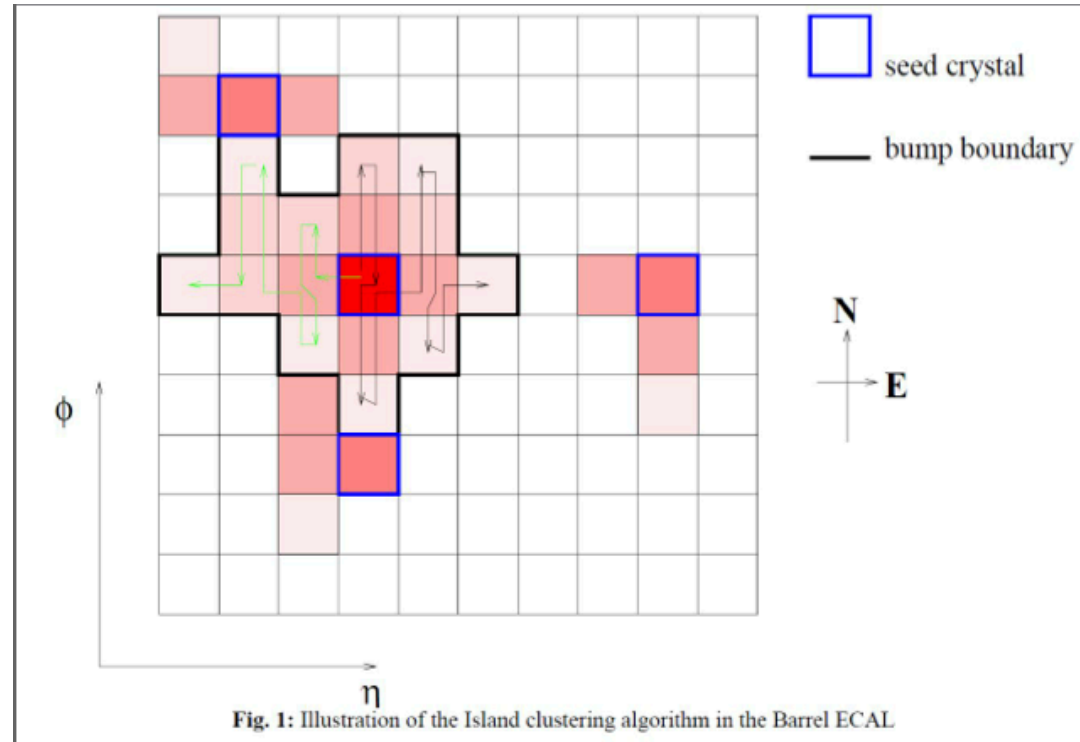
Jet Structure Meetings

- July 26th: <https://indico.bnl.gov/conferenceDisplay.py?confId=2268>
 - 2 talks on Clustering algorithms
 - Brandon McKinzie, Justin Franz
 - 1 on the particle flow
 - Yen-Jie Lee
- Next meeting is August 9th at 11 am

The Island Algorithm at CMS

Procedure:

1. Store “seed” towers.
Defined by $E_T > E_T^{\text{thresh}}$
2. Remove seeds adjacent to higher energy ones.
3. Starting from highest energy seed:
 - a. Move both directions in ϕ until rise in energy or hole.
 - b. Move one step in η .
Repeat ϕ search.
 - i. Continue along η until energy rise or hole.

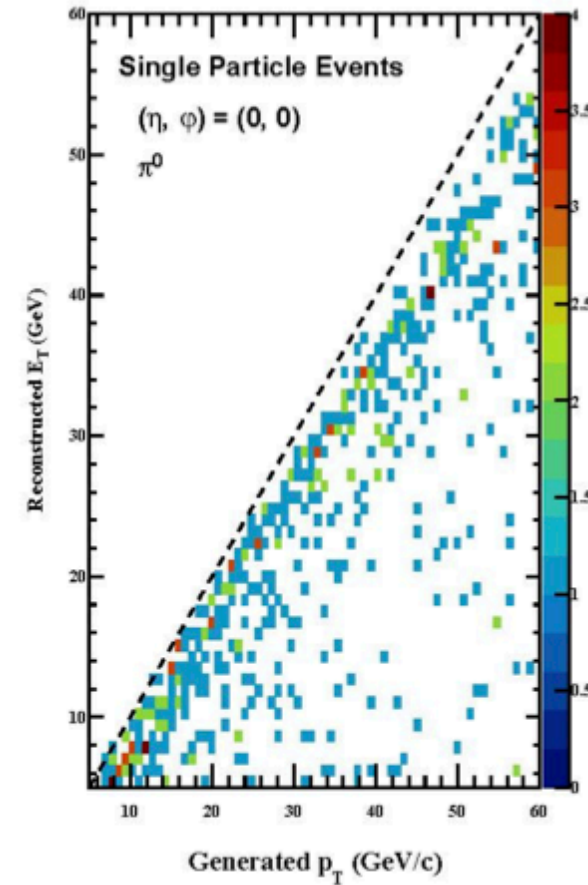
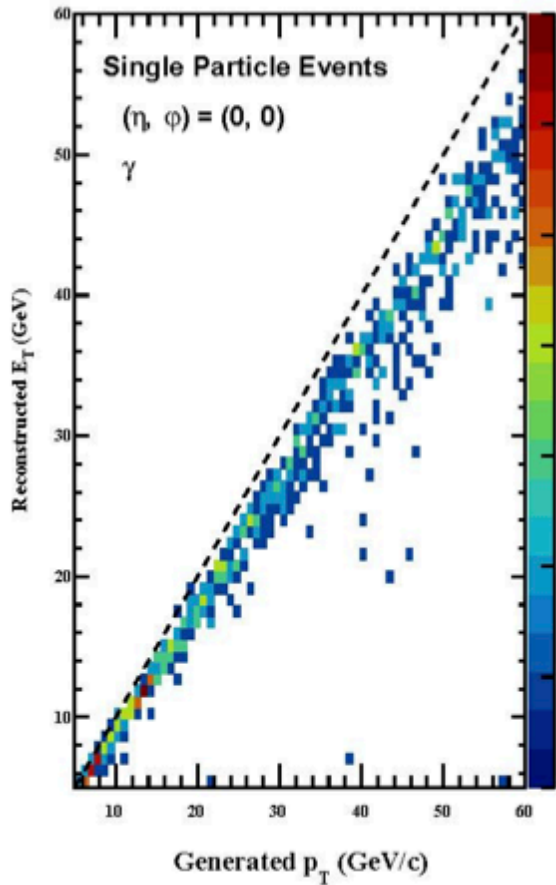


Will be incorporated into a module for use by all

Clustered E_T vs Generated E_T

Generate single-particle events

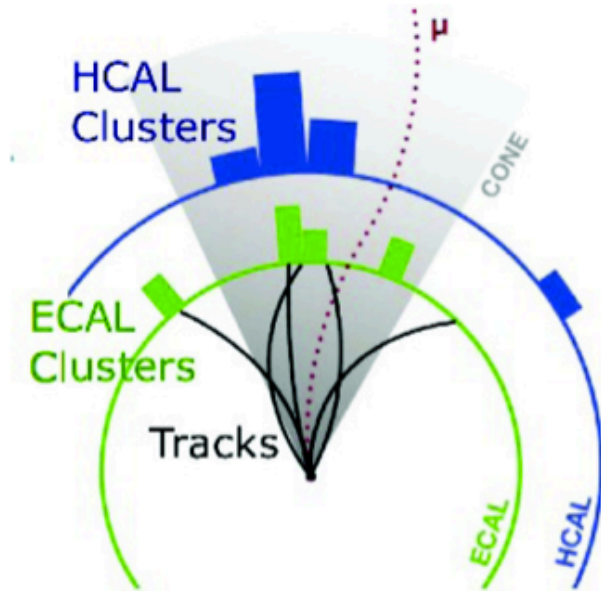
- $(\eta, \phi) = (0, 0)$
- noise included
- Plot the cluster E_T vs generated p_T



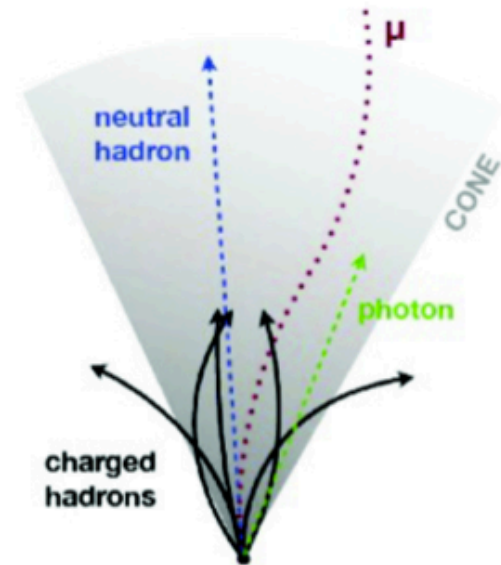
Particle Flow

Particle flow reconstructs all stable particle in the event: $h^{+/-}$, γ , h^0 , e , μ

clusters and tracks



Particles

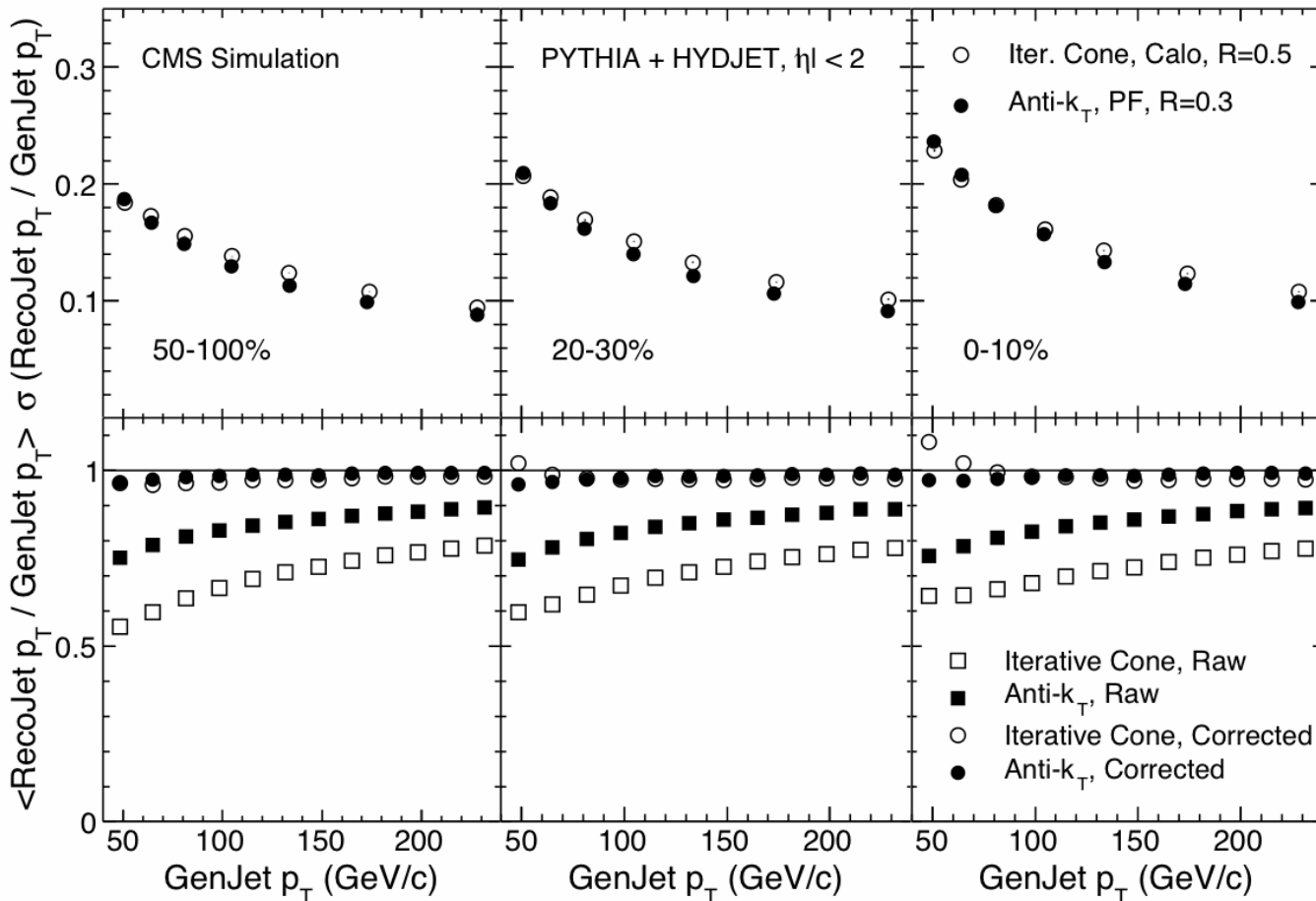


- On average jets are:
 - $\sim 65\%$ charged hadrons, $\sim 25\%$ photons, $\sim 10\%$ neutral hadrons
- Using the silicon tracker (vs. HCAL) to measure charged hadrons
 - Improves resolution, avoids non-linearity
 - Decreases sensitivity to the fragmentation pattern of jets
- Used extensively in ALEPH, CMS and proposed for the ILC

PF Jet Performance in PbPb

Resolution: PF jet performance similar to calorimeter jets

Competing effects: Better energy resolution of constituents, but increased in/out-of-jet migration due to smaller R

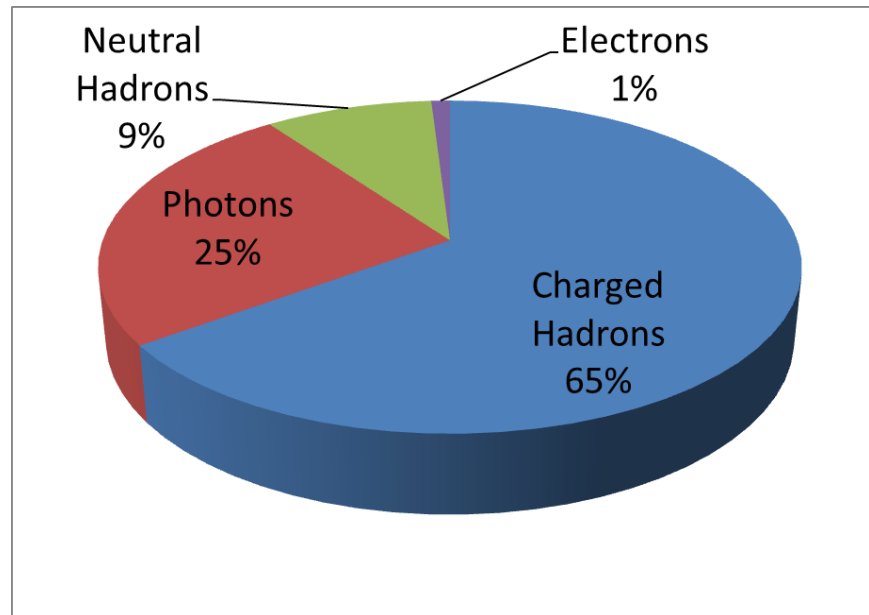


Raw response: closer to unity for PF → reduced uncertainty due to JES

Corrected response: good closure → PF robust against multiplicity

What do we expect with sPHENIX?

	3.8 T	1.5 T	2 T	sPHENIX 1.5 T
Magnetic field	3.8 T	1.5 T	2 T	1.5 T
Lever arm	1.29 m	1.8 m	1.4 m	-
Bending power	4.9 Tm	2.7 T.m	2.8 Tm	-
Pion reconstruction efficiency ($p_T = 5$ GeV)	90-95%	99%	90-95%	95%
Tracker thickness at $\eta = 0$ (λ_I)	0.35	0.02	0.4	-
ECAL Molière radius	2.2 cm	1.6 cm	4.0 cm	-
ECAL granularity	0.017×0.017	0.015×0.015	0.025×0.025	0.025x0.025
ECAL resolution	$\frac{3\%}{\sqrt{E}} \oplus \frac{12\%}{E} \oplus 0.3\%$	$\frac{18\%}{\sqrt{E}} \oplus 0.9\%$	$\frac{10\%}{\sqrt{E}} \oplus 0.17\%$	15%
ECAL longitudinal segmentation	no	yes	yes	-
HCAL granularity	0.085×0.085	0.06×0.06	0.1×0.1	0.1x0.1
HCAL resolution	$\frac{110\%}{\sqrt{E}} \oplus 9\%$	$\frac{85\%}{\sqrt{E}}$	$\frac{55\%}{\sqrt{E}} \oplus 6\%$	120%



Tracking Review

- Planning a big push between now and next general meeting → Will show results
- Plan to repeat common-use MC sample model
 - Tracking performance in jets for FF measurements (where jet cone limits fake rate)
 - Tracking performance at all- p_T for missing- p_T or charged hadron spectra (possibly with calo-matching)
- Tasks
 - Track-cluster matching
 - Fake jet rejection via track, track-jet or cluster matching
 - Flavor-dependence of jet performance
 - Blind unfolding tests of modified jet spectra or FF
 - Response to quenched jets

General Outlook

- Jet Structure will transition to work towards longer term payoff:
 - Develop reconstruction/analysis infrastructure in software
 - Benchmark detector performance with latest simulations & software updates
- However, we understand that the Tracking Review has a short time scale and will have priority